Environment Canada Environment Canada

Canada

CANADA-U.S. AND INTERPROVINCIAL RIVERS IN THE ATLANTIC REGION AN OVERVIEW AND HISTORICAL PERSPECTIVE

IWD-AR-WPMB-85-91

CANADA - U.S. AND INTERPROVINCIAL RIVERS IN THE ATLANTIC REGION:

AN OVERVIEW AND HISTORICAL PERSPECTIVE

IWD-AR-WPMB-85-91

Inland Waters Directorate
Water Planning & Management Branch
Atlantic Region
Dartmouth, Nova Scotia
October, 1985

ABSTRACT

This paper provides an historical overview of the various water related interjurisdictional issues which have arisen in the Atlantic Region in the past 150 years.

Interjurisdictional water-related concerns of varying degrees, regarding both water quantity and quality, have arisen in the international areas of the St. Croix and Saint John River Basins of New Brunswick. Additionally, both New Brunswick and Newfoundland-Labrador share watersheds with Quebec. With the exception of the Quebec-New Brunswick case, the dimensions of these situations are examined here, focussing primarily on the international aspects. Relatively sparse development in the transboundary waters area between Quebec and New Brunswick has precluded the evolvement of significant water management concerns in that area.

The establishment of the Boundary Waters Treaty of 1909 and the International Joint Commission, which provides a forum and a framework to address Canada-United States water issues, are chronicled here. The various organizations and programs which have been subsequently established to contend with water management issues in the international and interprovincial waters of the Region are also discussed.

RÉSUMÉ

Ce rapport donne une perspective historique des divers problèmes des eaux interjurisdictionnelles qui se sont présentés dans la région Atlantique pendant les derniers 150 ans.

Des problèmes d'intérêt de degrés divers envers les eaux interjurisdictionelles, touchant à fois la quantité et la qualité des eaux, se sont présentés dans les régions internationales des bassins hydrologiques de la St. Croix et de la Saint Jean au Nouveau Brunswick. De plus, le Nouveau Brunswick et Terre Neuve-Labrador partagent plusiers bassins hydrologiques avec le Québec. A l'exception du Québec-Nouveau Brunswick, les dimensions de ces situations sont examinées ici et se concentrent principalement sur les aspects internationaux. Le faible développement dans les régions transfrontalières entre le Québec et le Nouveau Brunswick a prévenu l'évolution de problèmes significatifs envers la gestion des eaux dans cette région.

L'établissement du traité des eaux transfrontalières en 1909 et de la commission jointe internationale qui permet un forum et un méchanisme pour addresser les problèmes reliés aux eaux entre le Canada et les Etats-Unis, sont ici détaillés. Les organisations et les programmes divers qui furent établis subséquemment pour faire face aux problèmes de la gestion des eaux internationales et interprovinciales dans la région sont aussi discutés.

TABLE OF CONTENTS

		PAGE
	ABSTRACT	i
	TABLE OF CONTENTS	ii
	LIST OF FIGURES	iii
I.	INTRODUCTION	1
II.	THE BOUNDARY WATERS TREATY AND THE INTERNATIONAL JOINT COMMISSION	7
III.	THE INTERNATIONAL ST. CROIX RIVER BASIN	14
	A Basin Description	14
	B The 1955 IJC Reference	14
	C Basin Activities since 1955	19
	D The Role of Federal Water Management Agencies in the Basin since 1955	20
	E Current Issues in the St. Croix River Basin	25
IV.	THE INTERNATIONAL SAINT JOHN RIVER BASIN	26
	A Basin Description	26
	B The Chamberlain Lake Diversion	26
	C The 1952 IJC Reference	27
	D Hydropower Developments in the Basin since 1952	29
	E The Role of Federal and Federal-Provincial Water Management Agencies in the Basin	29
	F Current Issues in the Saint John River Basin	36
V.	THE LABRADOR-QUEBEC TRANSBOUNDARY BASINS	38
	Potential Water Management Concerns	38
VI.	SUMMARY	42
VII.	REFERENCES	44

LIST OF FIGURES

		PAGE
1.	The International Saint John River Basin	3
2.	The International St. Croix River Basin	4
3.	The Interprovincial Restigouche River Basin	5
4.	Transboundary Quebec-Labrador Basins	6

I. INTRODUCTION

A major program objective within Environment Canada is to provide support to the process whereby Canadian interests are protected in any dispute with the United States involving boundary water management issues, while at the same time allowing for the realization of bona fide economic development interests on both sides of the border. This objective derives primarily from the provisions of the Boundary Waters Treaty of 1909. The essence of this treaty is that a formal consultative framework for dealing with interjurisdictional issues as they arise will help avoid most bilateral disputes between the two countries before they reach crisis proportions. In the process of implementing this concept in Atlantic Canada, several consultative committees have been used over the years to deal with various water management issues. The primary purpose of this report is to provide an historical perspective on what these issues were and how they have been resolved by these different agencies. In some cases, the issues remain unresolved, so the report will also review their current status.

Because the Boundary Waters Treaty is the cornerstone of this consultative approach, a review of its main provisions is provided in Section II. This is followed by a chronological sketch of all events and agencies involved in the International Joint Commission (I.J.C.) references dealing with the St. Croix Basin (Figure 1) and Saint John River Basin (Figure 2). Even though not all of the items discussed in these sections of the report are directly related to an I.J.C. reference, they are included in order to provide additional insights into what else was occurring at the time on the Canadian side of each issue.

In addition to its interest in water management issues in international river basins, Environment Canada is also concerned with the prevention and resolution of problems involving two or more provincial jurisdictions. In the Atlantic Region, both New Brunswick and Newfoundland-Labrador share significant water resources with the Province of Quebec.

In New Brunswick, this includes the Upper Saint John River Basin and the Restigouche River Basin (Figure 3). In the case of the former, relatively sparse development in the area of interprovincial waters has precluded the evolvement of significant water management concerns. In the case of the latter, most development and activity is focussed in the estuary area, again thereby precluding the evolvement of significant interjurisdictional water management concerns within a river basin context. For these reasons, these two interprovincial watersheds are not discussed in this report.

In the Labrador case, hydro development potential in a series of Quebec-Labrador watersheds (Figure 4) poses water management implications for the future. Some discussion of these issues and the agencies involved is included in this report.

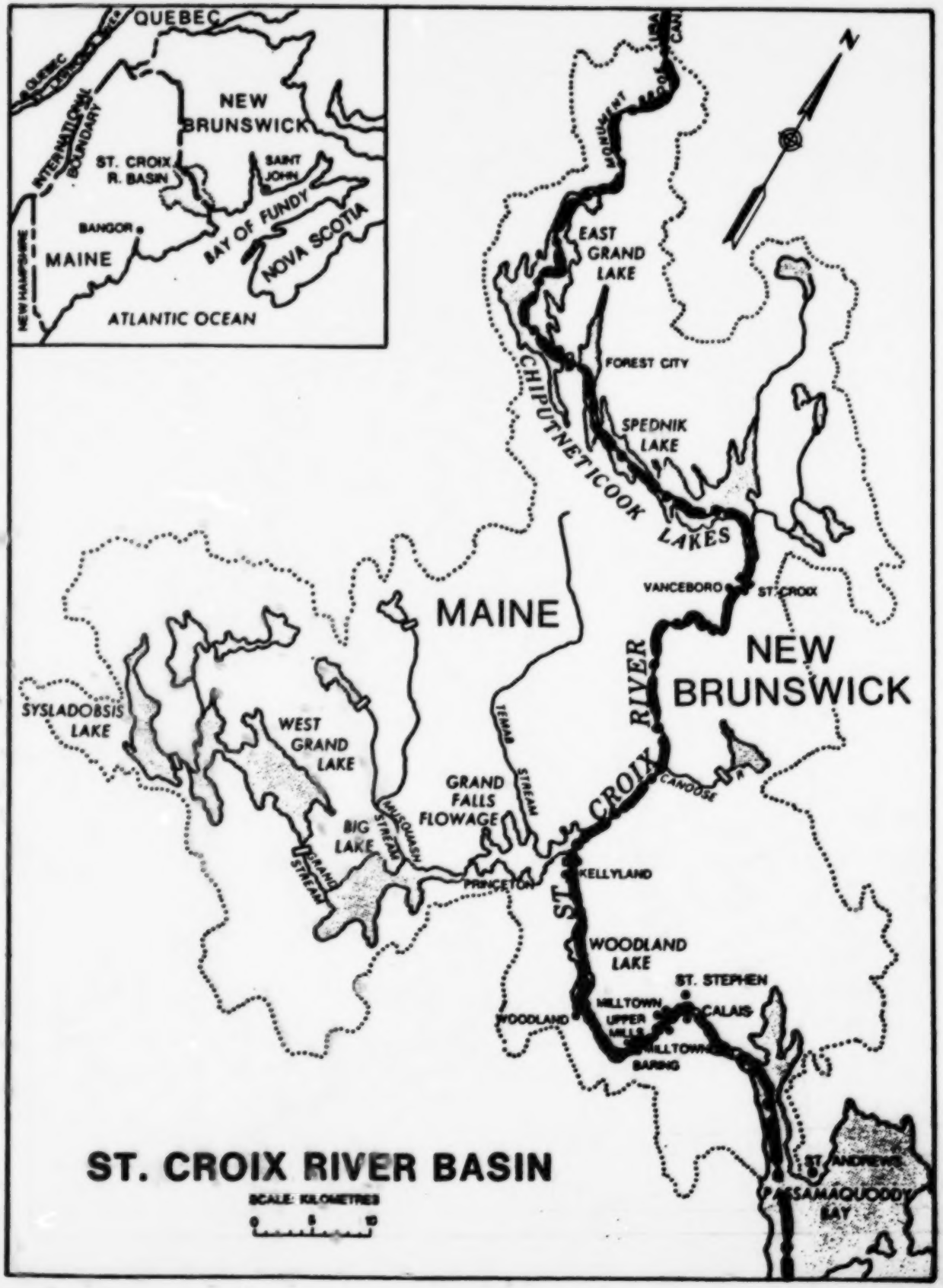
QUEBEC
NEW BRUNSWICK
ST. CROIX R. BASIN
SAINT JOHN
BAY OF FUNDY
NOVA SCOTIA
BANGOR
MAINE
NEW HAMPSHIRE
ATLANTIC OCEAN
INTERNATIONAL BOUNDARY
MONUMENT
EAST GRAND LAKE
FOREST CITY
SPEDNIK LAKE
CHIPUTNETICOOK LAKES
VANCEBORO
ST. CROIX
MAINE
NEW BRUNSWICK
ST. CROIX RIVER
SYSLADOBSIS LAKE
WEST GRAND LAKE
TEMAH STREAM
GRAND FALLS FLOWAGE
CANOOSE
BIG LAKE
MACHIQUAGEN STREAM
GRAND STREAM
PRINCETON
KELLYLAND
WOODLAND LAKE
ST. STEPHEN
MILLTOWN
UPPER MILLS
CALAIS
WOODLAND
MILLTOWN
BARING
ST. ANDREWS
PASSAMAQUODDY BAY
ST. CROIX RIVER BASIN
SCALE: KILOMETRES
0
10
N

Fig. 1

THE SAINT JOHN RIVER BASIN
GULF OF ST. LAWRENCE
PRINCE EDWARD ISLAND
NEW BRUNSWICK
QUEBEC
MAINE
CANADA
U.S.
SAINT JOHN RIVER BASIN

Fig. 2

RESTIGOUCHE RIVER BASIN
(INTERPROVINCIAL)
Matapedia River
Patapedia River
Restigouche River
Upsalquitch River
Saint John River
EDMUNDSTON
CAMPBELLTON
Matapedia
Pabineau
Redgrave
SCALE

Fig. 3

UNGAVA BAY
TRANSBOUNDARY BASINS
QUEBEC – LABRADOR
SCALE
QUEBEC
LABRADOR
LABRADOR SEA
Fraser River
Smallwood Reservoir
Churchill River
Hamilton River
GOOSE BAY
CARTWRIGHT
Eagle's River
Little
Strait of Belle Isle

Fig. 4

II. THE BOUNDARY WATERS TREATY AND THE INTERNATIONAL JOINT COMMISSION

The Boundary Waters Treaty between the United States and Great Britain was signed in Washington on January 11, 1909. Ratifications were exchanged in Washington on May 5, 1910 and the Treaty was proclaimed on May 13, 1910. The U. S. members of the I.J.C. were first appointed on March 9, 1911, and the Canadian members were first appointed on November 10, 1911. Amendments to the Treaty were made on November 11, 1914; April 7, 1915; April 6, 1926; and December 2, 1964.

At the time of the signing of the Treaty, both Great Britain and the U.S.A. wished to avoid new disputes regarding the use of boundary waters, as well as to resolve any outstanding issues. Accordingly, the Treaty established the following:

In the preliminary article, boundary waters are defined as waters extending from the main shore on one side of the international border to the main shore on the other side. The waters in lakes, rivers, connecting waterways (or parts of them), bays, arms and inlets, which are part of the water bodies are also included. The water from tributary streams, which flow naturally into the boundary waters, are not included.

Article 1 specifies that free navigation in all navigable waters is to be enjoyed by both countries as long as the Treaty remains in force. This right of navigation includes all canals connecting boundary waters on either side of the line, whether already existing or constructed in the future. The same toll rates (if any) would apply to citizens of both countries on these waterways.

Article 2 indicates that each country (province or state) has jurisdiction and control of waters on its own side of the line. That is, to the use and diversion of waters, either temporarily or permanently.

If these changes would cause damages to residents on either side of the boundary, they are entitled to the same legal rights and privileges for any damages incurred as if they were citizens of the country where the interferences originated. However, each country can object to any alterations taking place on the other side which would interfere with waters and navigational interests on its own side.

Article 3 states that no further uses, obstructions or diversions, which might affect the level or flow of water on either side of the boundary can be made without the authority of the United States or Canada, within their respective jurisdictions, and the approval of the International Joint Commission (I.J.C.).

These provisions are not intended to interfere with, or impede, the existing rights of each country with respect to the deepening of channels, breakwater construction, and other harbour improvements for the benefit of commerce and navigation, so long as it takes place on each country's own side of the line, and does not affect the level or flow of water on the other side, or interfere with the ordinary uses of water for domestic and sanitary purposes.

Article 4 asserts that for any alterations of works affecting the level of flow of water across the boundary line, prior approval by the I.J.C. is required. Furthermore, no pollution of boundary waters is permitted that would be injurious to the health or property of citizens on the other side.

Article 5 deals specifically with the diversion of water from the Niagara River and the maintenance of Lake Erie levels.

Article 6 deals specifically with the withdrawal of water from the St. Mary's River (Montana) and the Milk River (Alberta and Saskatchewan), including their tributaries, for irrigation purposes.

Article 7 is concerned with the appointment of Commissioners to the I.J.C. Three are appointed by the President of the United States and three are appointed by the Canadian Governor-General.

Article 8 states that with respect to the use, distribution or diversion of waters as discussed in Articles 3 and 4, the International Joint Commission has jurisdiction over all cases and its approval is required. Equal and similar rights are extended to both countries regarding the use of boundary water. The I.J.C. shall be guided by the following order of preference for uses as: 1) domestic and sanitary purposes; 2) navigation, including the servicing of canals for navigational purposes; and 3) power and irrigation purposes. Article 8 also states that previous agreements on boundary waters shall not be affected by the above provisions, and that equal division of water for withdrawal may be waived depending on the circumstances. For example, although equal and similar rights are afforded to both countries in the use of boundary waters, temporary diversions along boundary waters can be made if no disadvantages result to the other side .

The I.J.C may make approvals on the condition that certain remedial or protective works be done to compensate for a particular proposed diversion. As part of this approval process, the I.J.C. would require adequate protection and indemnity of all interests on the other side.

Similarly, in cases where the natural level of water is caused to rise on the one side by the construction of works on the other side, the Commission would require, as part of the approval package, the provision of adequate protection and indemnity of citizens on the other side against injury.

Article 9 states that for any differences arising between the two countries with regard to rights, obligations or interests (either involving governments or citizens of each country along the boundary waters), they shall be referred to the I.J.C. for study and examination, and the I.J.C. shall make reports when requested by either government. The I.J.C. is only authorized to examine the facts and circumstances surrounding a particular matter; to draw conclusions; and to submit appropriate recommendations, subject to the terms of reference. These reports are not to be construed "as decisions of the questions or matters, either on the facts or the law", nor would they have the appearance of an arbitral award. In all cases where there is unanimous agreement of the I.J.C., joint reports are done for both governments. When there is disagreement, the minority may make a joint report to both governments, or separate reports to their respective governments. In the case of a draw, separate reports would be made by members on each side to their own governments.

Article 10 states that any differences arising between the two countries may be referred to the I.J.C for a decision, subject to the approval of the U.S. Senate and the Canadian Governor-General in Council. The I.J.C. is then authorized to examine and report on the facts of a particular case along with conclusions and recommendations which are appropriate to the terms of reference. A majority will constitute a decision. If equally divided, or unable to render a decision, the Commissioners may make joint reports to both governments or separate reports to their own government describing the different conclusions reached on the particular case. The case would then be referred to an umpire for a decision. The umpire would be selected according to the

procedure delineated in the fourth, fifth and sixth paragraphs of Article 45 of the Hague Convention, dated October 18, 1907.

Article 10 was amended on December 2, 1964. After the amendment, in any case that is referred to the I.J.C. for decision, the Commission has the authority to make any "rules of procedure" it deems appropriate, after consultations with both the U.S. and Canadian Governments.

Article 11 specifies that all decisions rendered and all joint reports made by the I.J.C. are to be in original duplicates, and filed with the Secretary of State and the Governor-General. Moreover, all communications of the Commission shall be addressed to both these parties jointly.

Article 12 indicates that meetings of the I.J.C. are to be held at the call and direction of both governments, as well as at times determined by the Commission itself. Each section may appoint a secretary, and they shall act as joint secretaries during joint meetings. The Commission may hire engineers and clerical help when needed, administer oaths to witnesses, take evidence and issue subpoenas, and adopt rules and procedures in "accordance with justice and equity."

Article 13 states that as well as the direct agreements reached during the negotiation of the Boundary Waters Treaty, any mutual agreements existing at the time between the United States and Canada which were documented in on-going or reciprocal legislation between the U.S. Congress and the Canadian Parliament, would also be an integral part of the Treaty.

Article 14 describes the process for ratification of the Treaty and reiterates that previous agreements reached by the two governments on boundary waters, still hold.

A number of other miscellaneous items, included in the Rules of Procedure of the I.J.C., are listed below:

A chairman is appointed for each section of the I.J.C. (Canada and the U.S.). All meetings held in the U.S. are to be chaired by the U.S. Chairman, and those in Canada by the Canadian Chairman. If the chairmen cannot attend the meetings, the commissioner who is next in line for appointment shall direct the meetings.

If either the U.S. or Canadian Governments seek the approval of the Commission for the alteration of boundary waters (Article 3 and 4), it must file with the Commission all the necessary information for the proposed project. If a private person seeks approval for the use, obstruction or diversion of boundary waters, he must apply to his own government (or department) which has jurisdiction over the undertaking. The government agency then transmits the application to the Commission requesting appropriate action. The application is then processed as if it were from one or the other governments. As soon as it is practical, the secretary will arrange for its publication for three consecutive weeks in the Canada Gazette and in two weekly newspapers, one on each side of the border, nearest the place where the action is to take place. Any interested private citizen, who reads or hears of the application, has the right to be heard before the Commission.

Within 30 days after filing an application, or longer if the Commission decides, any private citizen may provide additional information relating to the modification, defeat, or approval of the project, in accordance with protocol. The Commission is requested to reply within 30 days after receipt of the additional information. The Commission may request additional information.

Any interested private person, whether for or against the project has the right to be heard with counsel at the final hearing. Furthermore, he or she, through counsel and with the permission of their government, could conduct or assist in proceedings against the application.

III. THE INTERNATIONAL ST. CROIX RIVER BASIN

A) Basin Description

The St. Croix River (Figure 1), throughout its entire length of approximately 124 km, including the Chiputneticook Lakes (Grand and Spednic), forms the international boundary between southeastern Maine and southwestern New Brunswick. In most of the drainage area and for the upper 110 km, the St. Croix River is considered to be pristine. Of the total basin area of approximately 4,235 km^2, 2,616 are in Maine and 1,619 are in New Brunswick.

B) The 1955 I.J.C. Reference

On June 10, 1955, the Canadian and U.S. Governments directed the I.J.C. to study the redevelopment of the St. Croix River Basin for the improvement of the use, conservation and regulation of the waters of the Basin. Subsequently, on September 9, 1955, the International St. Croix Engineering Board received terms of reference from the I.J.C. to carry out the necessary investigations under the reference. It was directed to take into account previous orders by the I.J.C.; present conditions; and whether the future interests of either Canada or the United States would be benefitted or adversely affected by any new projects in the Basin. The determination of the total costs of projects, including indemnification to public and private properties, and how the costs should be divided, were to be considered as well.

The primary issues outstanding in the St. Croix Basin at the time of the 1955 I.J.C. reference were: (i) whether further development of hydro-electric power on the upper and lower reaches of the river would be economically feasible; (ii) existing fish and game resources and

consideration of the concept of rehabilitating anadromous species of fish into the system; (iii) water pollution and its sources;(iv) land management and the development of recreational assets.

At the time, both the United States and Canada were very interested in increasing the supply of hydro-electric power. Several potential sites had been investigated just prior to the 1955 study, but none had been found to be economically feasible for private development.

Studies conducted under the 1955 Reference identified three potential power sites in the upper reaches of the River (Little Falls, Steep Bank, and Canoose Rips), as well as a scheme to re-develop the Milltown site. These three sites were found by the study to be economically unfeasible at that time, but the Milltown site showed some promise for re-development.

Other studies conducted at about the same time (by the New England - New York Inter-Agency Committee and the St. Croix Paper Company) found that no additional storage sites were available which could be considered economically feasible for development. It was determined that the available storage potential in all areas above Vanceboro and Grand Lake Stream was already well developed. It was recognized that the storage reservoirs (ie. the Grand Falls Flowage) could be enlarged, but the flooding created by this action would incur significant relocations and land damage costs far in excess of the benefits which would be realized.

Regarding fish and game resources, the landlocked salmon has traditionally been the most sought-after coldwater species in the Basin. It is found mainly in the West Grand, East Grand, Spednic, Palfrey, Lambert, East Musquash, Pleasant, Nash and Deering Lakes above the Grand

Falls Flowage. The small-mouth bass is the most valuable game fish in the Basin and is found chiefly in the Grand Falls Flowage. It had previously been introduced into the Basin. It is a warm-water fish, competing for food with the cold-water species of trout and salmon. Trout occupy most of the streams and lakes in the Basin, and is a very important species for sports fishermen. Other species include chain pickerel, as well as yellow and white perch. The latter, a valuable species, is found extensively throughout the Basin.

Three dams (at Milltown, Woodland and Grand Falls) presented obstacles to the passage of anadromous fish (Atlantic salmon, alewives and shad) up the St. Croix River. Although these dams were equipped with fishways at the time of their construction, over time these fishways had deteriorated considerably and eventually became ineffective. The 1955 study recommended that new fishways be installed at each of these dams. Specifically, it was recommended: that the existing dams at Grand Lake Stream, East Musquash Lake and Syslodobsis Lake be provided with new fishways; that fishways at Lambert Lake, West Musquash and Clifford Lakes be provided with shut-off devices to permit cleaning; that the Spednic dam fishway be totally rebuilt; that the Tomah fishway pools be enlarged to permit efficient cleaning; that the channel of the West Branch of Musquash Lake be restored; that the Church dam on the West Branch of Musquash Stream be removed; that the Mud Lake Falls be further studied from the point of view of making improvements for the fishery; and finally, that minimum flows be provided to all important streams, by gradually drawing down the levels of the reservoirs.

At the time of the 1955 study, the St. Croix River between Woodland, Maine and the International Bridge at Calais-St. Stephen, was

grossly polluted. The major problem was the release of oxygen-consuming pollutants from the St. Croix Paper Co. mill at Woodland. These pollutants were reducing dissolved oxygen concentrations to dangerous levels for fish habitat. Furthermore, the release from the paper mill of settleable solids, such as wood waste, pulp fibers, bark and coal ash had blanketed sections of the river bed, altered the natural aquatic life, and accelerated the rate of oxygen depletion. Some areas were covered by a slime or mould growth, while others showed a covering of coal-ash slag. However, the main channel was free of wood-waste islands in most reaches. Spent sizing, dyes and detergents from the textile mill at Milltown (now defunct) was another source of industrial pollution. The discharge of untreated municipal waste at Woodland, Baring and Milltown (Calais and St. Stephen discharged raw sewage to the estuary) increased the biochemical oxygen demand as well as being sources of bacterial pollution. Finally, untreated domestic waste discharged from Calais and St. Stephen was also responsible for occasional closures of shellfish beds in certain areas of the estuary.

In its report on the Pollution of Boundary Waters, 1951, the I.J.C. had compiled a list of general and specific objectives for pollution control in the waterways connecting the Great Lakes. At that time, both the U.S. and Canadian Governments had also adopted these objectives for the St. Croix River.

The general objectives specified that primary treatment should be provided for municipal wastes, and the discharge of solids such as coal-ash and coarse wood (knots, slivers, bark, etc.) should be prevented. The water's pH and industrial oxygen-consuming pollutants were to be controlled as well.

The report of the 1955 Reference recommended that facilities be installed at St. Croix Paper Co. Ltd. to prevent physical pollution of the river, and to treat oxygen-consuming pollutants emanating from mill processes.

In addition, it was recommended that facilities be provided for the treatment of domestic wastes, particulary at Woodland and Calais, Maine; and at St. Stephen and Milltown, New Brunswick.

The St. Croix River Basin is today, and was, in 1955, largely forested, (80 % of the total land area). Only about 10 % is used for agriculture, and marshlands account for much of the remainder. Spruce, balsam fir, pine, hemlock and cedar comprise most of the coniferous species. Birch, maple and poplar are the most numerous of the deciduous species.

In 1955, lumbering and pulp wood cutting were carried out extensively. River log-driving has practically ceased today, but was widely practiced at that time. Forest fires had caused significant damage in the past, but they had been brought under better control in recent years by improvements in forest-fire protection measures. No reference is made in the report to the spruce budworm or other insect infestation of the forests. The areas cultivated for agriculture were small, and were decreasing in size.

The Basin was and is very attractive for many types of recreational uses, (e.g. camping, fishing, hunting, canoeing, and other associated activities). In addition to public development of the recreational potential of the Basin by providing new access roads, campsites, parks and picnic sites, several commercial and private developments had occurred in the Basin by 1955.

The 1955 report recommended that stream flows should be regulated by releasing stored water to maintain minimum dependable flow during periods of low water levels. The objective here was to enhance power generation, as well as fisheries and recreational interests. The report stated that sudden fluctuations in stream flows caused by manipulation of reservoir levels were to be avoided, and that the regulation of flow for pulpwood driving was to be coordinated with the requirements of other water users.

C) Basin Activities since 1955

Since the 1955 study, no additional sites have been developed for the production of hydro-electricity, no existing storage sites have been enlarged, and some have even been eliminated. Mechanical equipment has been replaced by electric generating equipment at the Milltown site, currently owned and operated by the New Brunswick Electric Power Commission (N.B.E.P.C.), and there have been no increases in either the size of the existing dam or in the storage capacity (personal communication with J.E. Peters, past Canadian member of the International St. Croix Board of Control).

Fishways were constructed and made operational at the Woodland and Grand Falls dams in 1965, and reconstructed at Milltown in 1980. The ascent of alewives and shad upstream has now begun. Salmon, for spawning purposes, have been introduced into the headwaters of the Basin. Ten thousand or more smolts have been released into the waters of the Basin as well, and their progress downstream on their way to the sea is being studied on an on-going basis (personal communication with N. McEachern, Fisheries and Oceans Canada).

Recommendations calling for the rebuilding of the Spednic dam fishway and the provision of minimum flows at the outlets of East Grand Lake, Spednic Lake, and at Baileyville have been implemented (personal communication with J.E. Peters). No increase in reservoir water levels has been permitted as yet.

In the 1960's, the St. Croix Paper Company was purchased by the Georgia Pacific Corporation. Kraft pulp is now being manufactured at the mill, and the newsprint facilities have been discontinued. Primary and secondary treatment facilities were installed during the 1970's to treat mill wastes. Bark and other wood solids are now contained at the mill site. However, Georgia Pacific has continued to cause high levels of both BOD and suspended solids during the occasional instances when treatment equipment malfunctions.

Sewage treatment and chlorination plants were installed at Calais, St. Stephen, Milltown and Woodland in the 1970's.

No action was taken with respect to the problem of coal-ash and wood solids covering parts of the river bed. They are no longer visible on the river bottom, having been either washed out of the system, or covered by sediment. It is generally accepted that more problems would be created by removing them than by leaving them undisturbed.

D) The Role of Federal Water Management Agencies in the Basin Since 1955

(i) International St. Croix River Board of Control

The International St. Croix River Board of Control is a committee of the I.J.C. It was established in the early 1920's to advise the I.J.C. on the discharge (flow) control mechanisms existing or planned for the Basin, and how they should be operated. The Board consists of a

Division Engineer with the U.S. Corps of Engineers (New England Division), and a member from the Inland Waters Directorate, Environment Canada, Atlantic Region. Semi-annual reports were prepared by the Board from 1966 to 1971, and annual reports have been produced since that time. The Board meets once a year in the Basin to discuss data needs and results with the agencies involved, and it makes periodic inspections (the latest occurred in 1980) of the facilities under its jurisdiction.

The Board has a policy of letting the owners of the dams under study regulate reservoir levels themselves, and only provides the supervision necessary to ensure that the Commission's orders are complied with. Reservoir water level data are provided to the Board by the owners of the dams, while discharge flows are provided by the United States Geological Survey or the Water Survey of Canada, depending on whether the hydrometric station is located in the United States or Canada.

On October 15, 1965, the I.J.C. approved the replacement of the old storage dam which stretched from Vanceboro, Maine to St. Croix, New Brunswick. A part of the approval specified a minimum flow at the dam and a maximum and minimum water level for Spednic Lake and East Grand Lake.

In the early 1970's, complaints from local residents and camp owners about the low water levels in Spednic Lake induced the I.J.C. to authorize the Board of Control to carry out a public attitude survey to assess the nature and extent of this problem. At the same time (April 10, 1972), the Board of Control was authorized to investigate the consequences of raising Spednic Lake to a pre-determined level, and also to study flow fluctuations below Vanceboro dam resulting from the operations of the control gate.

The attitude survey was completed in October, 1973. It showed that the overwhelming majority of camp owners and other residents were dissatisfied with the management of water levels in the Basin at that time.

In its report Spednic Lake Regulation Study, St. Croix River Basin, Maine and New Brunswick, January 1975, the Board of Control identified five different alternatives for the regulation of Spednic Lake. Option 4, which was recommended by the Board, involved maintaining the surface elevation of Spednic Lake at 378.5 feet above mean sea level (m.s.l.) or higher the year round, to maximize recreational benefits even to the possible detriment of fisheries during drought periods. The reason that this particular option was recommended was that it appeared to be the best alternative for satisfying the various interest groups involved with the issue.

Subsequent to this, the Board's Report on Conditions with Respect to the Control of the Discharge of the St. Croix River, Maine and New Brunswick at Forest City, Vanceboro, Grand Falls and Milltown (released February 23, 1979), reaffirmed the 1965 Order of Approval in which the Commission regulations pertaining to Spednic Lake provided that the minimum elevation between October 1 and April 20 be 371.5 feet above m.s.l., and between May 1 and September 30, 376.5 feet above m.s.l.

The Board agreed to use a rule curve developed by the Georgia-Pacific Corporation as the primary basis for regulation of the St. Croix River Reservoir system.

(ii) Public Health Engineering Division, Health & Welfare Canada

At the time of the June 10, 1955 reference, Canadian interests in the sampling, testing and evaluation of pollution control activities

in the Basin were represented mainly by the Public Health Engineering Division of the Department of National Health and Welfare, with some assistance from the Canada Department of Fisheries.

The Public Health Engineering Division carried out periodic analyses of water samples (mainly for B.O.D. and D.O.) taken at stations beginning just above the paper mill and ending at the International Bridge in St. Stephen, N. B. These samples were taken in order to monitor the effects of in-plant changes to the pollution control facilities at the St. Croix paper mill. The Division's findings were reported directly to the I.J.C. (Personal communication with D.H. Cullen, Chief, Water Quality Branch, IWD Atlantic, D.O.E).

(iii) Pollution Control Advisory Board

On April 3, 1962, a directive (including terms of reference) was issued by the I.J.C. regarding the establishment of a Pollution Advisory Board for the St. Croix River. This Board consists of six members all of whom are appointed by the I.J.C. Three members, including a chairman, represent Canada, while the other three members, including a chairman, represent the United States. The Canadian section chairmanship shifted from Ottawa to the Atlantic Region in 1980, and is currently filled by the Regional Director of the Environmental Protection Service.

In March and October of each year, progress reports are compiled by the Board for the I.J.C. on the status of pollution abatement in the watershed. Other topics also periodically covered by the reports are: surveillance; water quality objectives; salmon restoration; and pesticides. Information for these reports is derived primarily from government agencies on both sides of the border, including municipalities.

(iv) Environmental Protection Service

The Public Health Engineering Division was disbanded in 1969, and the Environmental Protection Service (E.P.S.) of Environment Canada took over its monitoring role. In 1972, the E.P.S. completed a biological survey on the St. Croix estuary and a study on the toxicological effects of the effluent from the Georgia Pacific pulp and paper mill. River surveys were also conducted in 1974, 1975 and 1978. At the present time, E.P.S. co-operates with the U.S. Environmental Protection Agency on pollution control in the Basin in addition to applying federal regulations and guidelines regarding the control of pollution from sources located in Canada.

(v) Water Quality Branch, Inland Waters Directorate

The Water Quality Branch is primarily concerned with ambient water quality conditions. It maintains an ambient quality monitoring network of 10 stations in the Basin and participates in special studies under the aegis of the Pollution Control Advisory Board. One recent activity of this type has been the development and implementation of a dissolved oxygen prediction model for the Basin.

In another study, a comparison was made between actual sample values obtained in 1980 and water quality objectives agreed to by the Pollution Advisory Board. Subsequently, test results of samples collected in the same year were compared with a set of Canadian Guidelines for Protection of Fresh Water and Aquatic Life. Test results indicated that values for iron, copper, cadmium, and aluminum were higher than those specified by the Guidelines. All other parameters tested met the Guideline specifications.

E) Current Issues in the St. Croix River Basin

The preceding sections outline the evolution of water resources management in the international St. Croix Basin.

Currently, the primary water management concern in the Basin is maintaining sufficient allocation of flows and levels amongst the various uses (notably hydropower, fisheries and recreation), particularly during occasional periods of relative drought. This has been identified as a problem at the present time at Spednic Lake storage reservoir in the upper portion of the Basin. Although the operator, Georgia-Pacific, is operating the reservoir well within the I.J.C.'s prescribed levels, below-normal precipitation over the past year has resulted in lowered lake levels and subsequent complaints from recreationists.

Additionally, occasions of municipal or industrial waste impacting adversely on the water quality of the Basin arise from time to time. Some concern is being expressed in this respect at the present time regarding municipal waste at St. Stephen, New Brunswick and at Calais, Maine, and industrial effluent from the Georgia-Pacific pulp and paper mill at Woodland, Maine.

A further potential issue is the possibility of additional hydropower development in the American portion of the Basin in the future, and the resulting impacts on downstream users.

The Inland Waters Directorate of Environment Canada maintains an up-to-date compendium of these and other related boundary water issues, and reports to the federal Department of External Affairs on their status on a semi-annual basis.

IV. THE INTERNATIONAL SAINT JOHN RIVER BASIN

A) Basin Description

The Saint John River Basin (Figure 2) is one of the largest watersheds in eastern North America and drains 44,000 km^2 of Maine, Quebec and New Brunswick into the Bay of Fundy. It originates at Little Saint John Lake on the border between Maine and Quebec, flows northward through Maine to St. Francis, where, for the next 109 km, it forms the international boundary between the United States and Canada. From there it flows southeastward through New Brunswick, meeting the Bay of Fundy at Saint John.

B) The Chamberlain Lake Diversion

One of the first internationally contentious issues involving the Saint John River Basin was the diversion of the headwaters of the Allagash River into the East Branch of the Penobscot River in 1841, by a canal at the south end of Telos Lake in north-central Maine. This issue, along with the ensuing recommendation of the International Joint Commission in 1911 and developments to 1927 are documented by K.G. Chisholm in the Report on the Chamberlain Lake Diversion at Headwaters of the Allagash River, Halifax, June 22, 1927, an article produced for the Department of the Interior, Canada, Dominion Water Power and Reclamation Service. This article summarizes the history up to 1927 of the Chamberlain diversion.

It is interesting to note that Canada has never accepted this diversion, and it continues to be a point of contention between the two countries. The issue has often been mentioned on the Canadian side as an item that should be included in any negotiations concerning development of the Dickey-Lincoln School power development project.

C) The 1952 I.J.C. Reference

The next significant event in the Saint John River Basin was the study Water Resources of the Saint John River Basin, Quebec-Maine-New Brunswick, Interim Report to the International Joint Commission, under the Reference of July 7, 1952, published by the International Saint John River Engineering Board, in April 1953.

On September 18, 1950, the United States and Canadian governments, in accordance with Article 9 of the Boundary Waters Treaty, instructed the I.J.C.to determine and recommend those projects beneficial to the public with respect to the conservation and regulation of waters above Grand Falls, New Brunswick. This reference was expanded, on July 7, 1952, to include projects above tide water (near Fredericton) rather than just above Grand Falls. Subsequently, the I.J.C. appointed the International Saint John River Engineering Board, consisting of two engineers from Canada and two from the United States. Representatives from private industry and public utilities, as well as various state and provincial agencies, also participated in this Board's studies so that both their interests and the information they provided could be included in the final report.

The Board dealt briefly with pollution problems in the River. It noted that raw sewage was being discharged into the Saint John River and its tributaries (there were very few treatment plants at the time). As early as 1913, the I.J.C. had reported that the international reach between Edmundston and Grand Falls was polluted by sewage and drainage from Edmundston and St. Leonard, N.B., and from Van Buren Me., as well as from upstream potato starch factories.

Although the Board did consider the pollution problem briefly, its primary mandate was to address the problem of a lack of power supplies to meet the needs of an expanding economy.

The Board's report stated that there were an estimated 536,000 kilowatts of hydro-electricity and 3,600,000 acre-feet of reservoir storage area capable of being developed. In the Board's view, three projects on the Saint John River below Grand Falls could generate up to 280,500 kilowatt-hours. However, the Board also indicated that any future development of these resources would depend on both the amount and the characteristics of future power loads. The Board stated that more intensive study would be needed to determine the nature of these loads as well as the feasibility, timing and priority of future development projects.

When considering the possible development of hydro-electric sites, the Board emphasized the need to consider the effects these developments would have on other water uses. Specifically, domestic and industrial water supply; pollution control; navigation (logging operations); flood control; irrigation; and fish and wildlife were all discussed.

As indicated above, the Board recognised that raw sewage was being discharged to the water courses of the Basin, and that treatment was being provided in only a few cases. In addition, there were large pulp and paper developments and agricultural industries which discharged large quantities of oxygen-consuming wastes. These were the most important concerns regarding other uses which were identified at the time.

D) Hydro Power Developments in the Basin since 1952

The Mactaquac power development, utilizing the Hawkshaw and Crock's Point sites, was commissioned in 1968. Four units had been installed at the site by 1972, and two more were added in the late 1970's to bring the total installed capacity to 630 MW.

The Beechwood power project was commissioned in 1957 with the installation of two 36 MW units. In 1962, a third unit rated at 43 MW capacity was added, which brought the total installed capacity to 115 MW.

The Sisson power plant was installed in 1965, and consisted of a single 8 MW unit. This plant was located 8 miles upstream from the confluence of the Sisson and Tobique Rivers. The Sisson reservoir also provides storage for the Tobique power plant further downstream.

E) The Role of Federal and Federal-Provincial Water Management Agencies in the Basin

(i) Atlantic Development Board

In the early 1960's, The Atlantic Development Board (A.D.B.) commissioned The Montreal Engineering Co. Ltd. to examine water supply and demand characteristics in each of the Maritime Provinces. The resulting intensive study was entitled The Maritime Provinces Water Resources Study published in 1969.

As had been the case in earlier studies, the primary concern identified in this report in the international section between Edmundston and Grand Falls, was pollution caused by the discharge of untreated waste from pulp and paper mills at Edmundston and Madawaska, as well as raw sewage from the major population centres. Upstream of Edmundston, water quality was not perceived to be a problem, except that some pollutants were being added to the river on the U.S. side at Fort Kent.

Below the international section, it was identified that a well-publicized fish-kill had occurred in the (international) Presqu'ile River in 1968 because of pollution from potato processing plants on the U.S. side of the border. Angry Canadian citizens blocked the river at the Canada - United States border in an attempt to prevent the river pollution from entering Canada, and legal proceedings were initiated against the offending plants. In addition, the other international tributaries (Aroostook and Meduxnekeag) were known to be polluted with potato waste on occasion.

Soil erosion was also identified as a problem in the Saint John Basin, causing large quantities of silt to be transported downstream. This was particularly evident in the Carleton, Victoria and Madawaska Counties due to the fairly steep slopes of the land and the silty nature of the soil.

Flooding had often occurred above Grand Falls, usually during the spring. For example, the flood of May 1961 had caused fairly heavy damages at Fort Kent.

A significant recommendation of the Board was that an international consultation committee should be established to help resolve technical resource concerns (not policy concerns) arising between the two countries. It was suggested that this committee be composed of representatives from the State of Maine (U.S.A.), and from New Brunswick and Quebec (Canada). This particular recommendation was never officially acknowledged by any of the committees which subsequently followed, but the concept of bilateral discussions of technical water quality issues was eventually formally adopted with the establishment of the Canada - U.S. Committee on Saint John River Water Quality.

(ii) Saint John River Basin Board

The Canada-New Brunswick Saint John River Basin Agreement was signed June 30, 1970 between the Governments of Canada and New Brunswick. The agreement was originally scheduled to last three years, and its objective was to produce a comprenensive river basin plan for the watershed. The administrative framework for joint planning consisted of the Saint John River Basin Board, (with three members representing the Federal government, and three members representing the Province of New Brunswick); an advisory liaison committee (which was appointed by the Board and consisted of a chairman and nineteen other members); and a planning office.

The planning studies undertaken by this Board also considered water supply and demand functions existing in the Basin at the time. In addition, the studies provided projections for the future based on a series of possible development scenarios. Ecological and aesthetic values, administrative, institutional and legal considerations, public involvement and international implications were also considered.

During the period of the agreement, and as a follow-up to one requirement of the Board's Interim Water Quality Plan, the Fraser Company Ltd.'s pulp and paper mill at Edmundston installed a clarifier and an aerated lagoon, whereby primary treatment was provided for one-half, and secondary treatment for a further one-third, of its effluent. As a result, about 90% of suspended solids and 27% of B.O.D. were removed. In 1981, with further plant modifications, the Fraser plant effected a 90-95% efficiency in solids removed. No other private companies were singled out for special attention in the international section of the river in the Interim Water Quality Plan.

The New Brunswick Water Authority also imposed a deadline of December 31, 1971 for most municipalities on the Saint John River to install secondary treatment facilities for domestic wastes. As a result, both Grand Falls and St. Leonard installed these facilities, thereby improving water quality in the international reaches to some extent. An aerated lagoon for the City of Edmundston, presently under construction, is expected to contribute significantly to improved water quality conditions in the reach.

At about the same time, meetings were also held involving planning and regulatory agencies on both sides of the border. One purpose of these meetings was to discuss ways of reducing waste inputs by communities on the United States' side of the Saint John River, as well as those located on the major international tributaries of the Saint John. The Board concluded from these meetings that on-going environmental programs in both countries were compatible with each other and had similar objectives.

The Board recommended that its ad hoc Canada-United States Committee on Water Quality be continued since this committee had produced a forum for discussion and co-operative initiative by all levels of government in both countries. The Board felt that liaison and negotiation should remain the basic means of communication of the standing Committee, and that direct communication amongst the various jurisdictions would be much more effective in dealing with water quality issues as they arose than would recourse to traditional (i.e. legal) avenues. The Board's concept in making this recommendation was that injunctions to force operators whose activities were harmful to downstream water quality might be issued by this committee, and then arbitrated by the International Joint Commission.

For the longer term, the Board developed a comprehensive plan for the optimum development and utilization of the Basin's water resources. A Plan for Water Management in the Saint John River Basin was published in 1975.

The major recommendations of interest in an international context were:

- That Basin-wide water quality objectives involving Maine and Quebec, as well as New Brunswick, should be developed.
- That Canadian drinking water guidelines should be the accepted standard for water quality incorporated into these objectives.
- That appropriate water quality objectives should be established for all reaches and tributaries (a distinction should be made here between the United States river water standards, which are fixed by law, and Canadian water quality objectives, which are not).
- That negotiations with appropriate agencies in Maine should be undertaken to help restore the Atlantic Salmon to the Saint John River and its tributaries.
- That an advisory committee, involving representatives from Maine, Quebec and New Brunswick, should be established to co-ordinate fishery management policies on both sides of the border.

(iii) Public Health Engineering Division, Health & Welfare Canada

A survey report on the Effects of Pollution, Saint John River Basin, New Brunswick and Maine, was published by the Department of Health

and Welfare for Canada (Public Health Engineering Division) in May, 1961. This report was intended to furnish the New Brunswick Water Authority with information on the levels of pollution in the Saint John River and its tributaries, including the international tributaries. Not surprisingly, the results of the survey, which had been carried out in the summer of 1960, showed that the international reach between Edmundston and Grand Falls, was grossly polluted, and very low in dissolved oxygen content. This was mainly due to the discharge of oxygen-consuming pulp and paper waste at Edmundston. Occasional fish-kills had been recorded in this reach of the river. The discharge of raw sewage to the river from major population centres also contributed to the pollution load. Conversely, the Aroostook and Tobique Rivers were found to improve the dissolved oxygen values in the Saint John River as far downstream as the Beechwood power dam. Similarly, the Presqu'ile River, which enters the Saint John River two and one-half miles below Florenceville, improved the dissolved oxygen values, but to only a limited degree because of its small size. Slight water quality deterioration had also been observed in the vicinity of the Town of Woodstock which was discharging raw sewage into both the Saint John and Meduxnekeag Rivers.

Another report, Head Pond Study Saint John River - Mactaquac, Beechwood, Tobique, Grand Falls, was published in 1968 by the Public Health Engineering Division for the New Brunswick Water Authority concerning pollution in the Saint John River Basin. The object of this report was to gather baseline biological, chemical and physical data in the respective headponds, so that subsequent changes in water quality might be evaluated. Based on test results of samples taken in August 1968, water quality in the Grand Falls headpond was observed to be poor

with respect to both dissolved oxygen and B.O.D. levels. Other parameters tested were apparently acceptable as far as fish life was concerned. Dissolved oxygen values in the Mactaquac and Beechwood headponds were observed to be much better than those at Grand Falls in the 0 - 20 foot depth range. However, at depths of 60 feet or more, the D.O. values approached zero which was far below the minimum requirement (5 p.p.m.) necessary for salmon and trout survival. Water quality in the Tobique headpond was found to be acceptable for both salmon and trout. In contrast with most downstream conditions, the water quality upstream of Edmundston was found to be very good. In addition, the water quality of the Aroostook, Meduxnekeag and Presqu'ile Rivers was found to be excellent.

(iv) Canada-United States Committee on Water Quality of the Saint John River

In September 1972, an agreement was reached by the governments of Canada and the United States on joint measures to co-operate in water quality planning and to recommend programs to enhance water quality on the Saint John River and its tributaries. The Canada-United States Committee on Water Quality in the Saint John River was subsequently established and the I.J.C. was designated to oversee its work.

The Committee provided a Report to Governments in 1976 which contained, among other things, preliminary water quality objectives for the international reach of the River. The I.J.C. reviewed the report, held public hearings and reported to the Canadian and United States governments in 1977.

In 1980, the Committee updated and further refined these objectives, and recommended to the jurisdictions that they be accepted as a

guide in developing pollution control measures. Seventeen individual parameters and a list of pesticides were selected for inclusion in the revised objectives. The selection was made on the basis that objectives should be restricted to parameters whose levels might be influenced by existing or predicted patterns of settlement and land use, and whose levels were amenable to local control. The Province of New Brunswick and the State of Maine both indicated that the primary use of the river was not for human consumption, and objectives were developed only for contact recreation and the preservation of fish and other aquatic life. It is intended that both the numerical objectives and the list of parameters will be reviewed periodically and updated on the basis of new scientific information or unanticipated developments in the river basin.

On February 22, 1984, the Governments of the United States and Canada renewed the Committee's mandate for an indefinite period of time.

F) Current Issues in the Saint John River Basin

The preceding sections outline the evolution of water resources management in the international Saint John River Basin.

Point sources of pollution in the Basin have been substantially dealt with in the past 10 - 15 years. During the period 1972 - 1982, point source pollutants were reduced by 88% in terms of B.O.D. loading and by 82% in terms of suspended solids discharged.

There remain, however, a number of water quality issues in the Basin which are currently of concern. For example, there is concern regarding the discharge of effluent into the headwaters of the river from base metal mining activities in the area of Bald Mountain, Maine (although there has been little recent activity due to depressed prices). Effluents

and wastes from poultry production and runoff from piggeries upstream of Edmundston are also causing some concern. And while the lack of sewage treatment facilities at Edmundston has been an on-going problem, an aerated lagoon for the City, presently under construction, is expected to vastly improve water quality conditions there. There also remain concerns regarding wastes from a number of municipalities and food processors in the Aroostook-Presqu'ile-Meduxnekeag Rivers area of Maine, (e.g. at Westfield, Mars Hill, Washburn and Houlton). Additionally, with the on-going efforts to resolve point sources of pollution in the Basin, it is felt that the relative impact of non-point sources will ultimately become more apparent and will eventually attract increased public attention.

Non-water-quality issues in the Basin are primarily related to hydro development. The Chamberlain Lake Diversion remains an unresolved but inactive issue. A proposed hydro project at Lincoln School Maine has been shelved indefinitely. And proposed redevelopment of the Grand Falls, New Brunswick hydro plant could, if implemented cause flooding of mainly agricultural lands in Maine.

The Inland Waters Directorate of Environment Canada maintains an up-to-date compendium of these and other related boundary waters issues, and reports to the Federal Department of External Affairs on their status on a semi-annual basis.

V. LABRADOR-QUEBEC TRANSBOUNDARY BASINS

Potential Water Management Concerns

Hydro development has long been the most significant water management issue in Labrador. The rivers of southern Labrador which cross the boundary between Quebec and Newfoundland are no exception. However, at the present time, development of these rivers for power production is not a critical issue in either Quebec or Newfoundland, mainly because both governments are more concerned with the apportionment of benefits from the Churchill Falls project which was developed in the 1960's. Nevertheless, it is not unreasonable to speculate that development of Southern Labrador Rivers will eventually become an issue between the two Provinces. In the following paragraphs, an attempt is made to provide an historical perspective on projected developments in the interprovincial rivers of Southern Labrador. Although the focus of this discussion is on the hydro potential of the area, other types of water-related developments are also considered.

In its 1969 report, Water Resources Study of the Province of Newfoundland and Labrador, Shawinigan Engineering Co. Ltd. did not deal with the Labrador-Quebec transboundary basins except in a general way. The report did recommend the installation of one meteorological station in the Nastashquan Basin, and one gauging station on the Little Mecatina River. At the time of that report, there were no official weather or gauging stations operating in these areas.

In the subsequent report of the Royal Commission on Labrador, (1974), three recommendations were made which had a potential for impact on the transboundary watersheds.

First, the Commission urged the responsible federal and provincial fisheries agencies to conduct freshwater research programs which would provide data on fish stocks and resource potentials. Moreover, programs were proposed for the development of new lodging and transportation facilities, and for the training of guides.

Second, the Newfoundland Government was urged to consult with both the appropriate Federal agencies and the people of Labrador regarding the development of plans for a new national park in Labrador, under consideration by Parks Canada at the time. As early as 1971, speculation had developed about the establishment of one or two national parks, and one area that received particular attention was the Mealy Mountain region on the south side of Lake Melville. Parks Canada has also studied the Mecatina Plateau in the Little Mecatina River Basin as a potential wilderness canoe route.

Third, a provincial forest research committee was recommended for the development of forest management techniques to control watershed pollution in Labrador.

The 1976 publication, The Ecological Land Classification of Labrador, A Reconnaissance, (Lands Directorate, Environment Canada), presented a general description, based on a very large scale reconnaissance of the climate, physiography, vegetation and resources of Labrador. The report noted that the Romaine River Basin had an extensive forest fire history which had reduced the forest cover to scattered and poor form stands. The future exploitation of the area's forest resources would, therefore, raise a number of environmental concerns. For example, clear-cutting practices might increase the rate of siltation in watercourses and place stress on fish stocks by interfering with their

migration, spawning and rearing functions. In addition, flood hazard potentials could increase if run-off rates were augmented.

In 1976, Shawmont Newfoundland Limited prepared a report for Newfoundland and Labrador Hydro on the Hydro-Electric Potential of Labrador Rivers. This appraisal, based on 1:50,000 and 1:250,000 topographical maps, was quite preliminary and only considered sites with at least 20 megawatts of dependable primary energy. The report discussed several hydro-power options available at the time.

Of these, the proposed Romaine River development was the largest. This project would involve the diversion of an estimated 6600 sq. km of drainage area into the Atikonak Lake of the Churchill River system by constructing a dam 24 kilometres south of the Quebec-Labrador border. As a consequence of the diversion, there would be an additional 593 MW installed in the existing Churchill Falls plant; 166 MW in the proposed Gull Island Plant, and 71 MW in the proposed Muskrat Falls plant. The Province of Quebec would have to agree to this scheme before it could proceed, since the main dam would be located in Quebec.

The Little Mecatina - Joir scheme envisaged the diversion of the Joir, Little Mecatina and Dominion Lake into the Minipi River, which is a tributary of the Churchill. The total drainage area diverted within Labrador would be approximately 10240 sq. km, and a total of 450 MW would be installed. Potential increased capacities at Gull Island and Muskrat Falls would be 119 MW and 51 MW respectively, if the latter two projects were eventually built.

The report did not identify any hydro-electrical development sites on any of the interprovincial rivers within Labrador itself. However, an estimated 3100 MW of dependable power is believed to be available from sites within Quebec.

A subsequent report, Study of Hydro-Electric Potential in Southern Labrador, prepared for the Newfoundland-Labrador Hydroelectric Power Corporation (N.L.H.P.C.) in 1978, discussed power development opportunities in Southern Labrador in more detail. With respect to schemes involving the transboundary basins, there are two levels of development which the report described as being economical. The first level would utilize a joint reservoir system, combining the Dominion and Minipi Lakes. Water diverted from 1870 km^2 of the Joir, 893 km^2 of the Kenamu, 3748 km^2 of the Little Mecatina, 2343 km^2 of the Minipi and 554 km^2 of the Dominion Lake River Basins would install a total of 592 MW. This scheme would represent the maximum development potential of the area. The total capital cost of this project was estimated at $757 million (1977 dollars).

The second development scheme discussed would utilize Dominion Lake as a reservoir and would involve the diversion of 3748 km^2 of the Little Mecatina River Basin and 554 km^2 of the Dominion Lake Basin to produce a total installation of 284 MW at an estimated capital cost of $380 million (1977 dollars). No development has yet begun on either of these schemes.

VI. SUMMARY

At the present time, much of the Environment Canada effort in interjurisdictional waters in the Atlantic Region is directed at monitoring and surveillance of both water quantity and quality variables, and at maintaining an information base applicable to potential water development projects in these areas, particularly those with international (Canada-United States) dimensions.

As indicated earlier in this paper, no significant water management issues currently exist in the interprovincial rivers between New Brunswick and Quebec. And in the case of Labrador/Quebec interprovincial waters, although there are potential issues regarding possible future hydro developments, there are no significant issues at present. The focus of this paper is, therefore, on the international dimensions; specifically regarding the St. Croix and Saint John River Basins.

In the St. Croix River Basin, two formal Boards of the I.J.C. are engaged in the monitoring process and reports are submitted regularly to the parent I.J.C. Water quality is monitored both to measure its conformity with recently established water quality objectives, and to maintain a current summary of water quality in the freshwater portion of the Basin. Water quantity is monitored by the International Board of Control. The most pressing water management concern today remains the same as it has for decades; that is, providing sufficient flow, particularly during dry periods, while at the same time allowing hydro and recreational interests to achieve sufficient storages to fulfil their particular needs. The establishment of fish ladders in some of the power dams over the years has somewhat alleviated the concern for migration of anadromous fish, but improvements still need to be made, particularly for downstream

migration. Plans are currently being developed to provide downstream fish passage facilities at Grand Falls, Woodland and Milltown.

In the Saint John River Basin, as stated by the International Saint John River Water Quality Committee in its 1984 report, although water quality is generally high due to light development, non-point sources of pollution are neither well controlled, nor well recognized. These include, among others, logging activities; malfunctioning or inadequate subsurface waste disposal systems at lakefront developments; combined sewer overflows; urban and agricultural runoff; and leachate from dumps and salt piles. The relative impact of non-point sources will probably become much more apparent as point source controls continue to improve. Between 1972 and 1982, point source pollutants have been reduced by 88% in terms of B.O.D. loading, and by 82% in terms of suspended solids discharged. The Committee will continue to monitor the River, the municipalities and industries in the Basin, and pursue the goal of making these international waters fit for swimming, drinking, and for the salmon and trout families. It cites continued international co-operation as the most important requirement of future pollution abatement programs.

VII REFERENCES

(References are listed chronologically for each section)

A. General

Bloomfield, L.M. and G.F. Fitzgerald: Boundary Waters Problems of Canada and the United States (the International Joint Commission 1912-1958), The Carswell Co., Ltd., Toronto 1958.

Atlantic Development Board: The Maritime Provinces Water Resources Study Stage 1, Montreal Engineering Company Ltd., Halifax 1969.

Environment Canada: Monograph on Comprehensive River Planning, Information Canada, Ottawa 1975.

B. St. Croix River Basin

Department of the Interior, Canada Dominion Water Power and Hydrometric Bureau: St. Croix River Report, Construction Work at Canadian Cottons Limited, Milltown, New Brunswick, 1934.

International St. Croix River Engineering Board: Water Resources of the St. Croix River Basin Maine - New Brunswick - Report on Preliminary Investigations to the International Joint Commission (under the Reference of June 10, 1955), Appendices, Volumes 1 and 2, and Supplementary Statement, September 1952.

International St. Croix River Engineering Board: Water Resources of the St. Croix River Basin, Maine - New Brunswick - Supplementary Report on Pollution Survey, 1959.

International St. Croix River Board of Control: Report on Public Attitude Survey, St. Croix River Basin, Maine - New Brunswick, Appendix B, April 1974.

International St. Croix River Board of Control: Spednic Lake Regulation Study, St. Croix River Basin, Maine and New Brunswick, and Appendices, January 1975.

International St. Croix River Board of Control: Report on Conditions with Respect to the Control of the Discharge on the St. Croix River, Maine and New Brunswick, at Forest City, Vanceboro, Grand Falls and Milltown, February 1979.

Inland Waters Directorate, Atlantic Region: Report on St. Croix River Water Quality, Water Quality Branch, 1980.

Inland Waters Directorate, Atlantic Region: Dissolved Oxygen Modelling of the St. Croix River, Maine - New Brunswick, Water Planning & Management Branch, 1981.

Inland Waters Directorate, Atlantic Region: 1983/84 St. Croix River Water Quality Report, Water Quality Branch, 1984.

C. Saint John River Basin

New Brunswick Electric Power Commission: Report on Investigation of Grand Falls Power Development on the Saint John River, 1923.

New Brunswick Electric Power Commission: Supplemental Report on Investigation of Grand Falls Power Development on the Saint John River, 1924.

Acres, H.G.: Report on Development of Grand Falls, 1924.

Weston, S.R.: Report on Investigation of the Meductic Site, 1927.

Department of the Interior, Canada Dominion Water Power and Reclamation Service: Report on the Chamberlain Lake Diversion at Headwaters of the Allagash River, 1927.

International Joint Commission: Pollution of Boundary Waters, 1951.

International Saint John River Engineering Board: Water Resources of the Saint John River Basin, Quebec-Maine, New Brunswick, Interim Report to the International Joint Commission, under the Reference of July 7, 1952, 1953.

James F. McLaren Ltd.: Report to the New Brunswick Water Authority on Preliminary Survey of Pollution in the Saint John River's Watershed, Toronto, 1958.

Saint John River Board: Effects of Storage on Power Generation in New Brunswick: Report, 1960

Department of Health and Welfare (Public Health Engineering Division): Effects of Pollution, Saint John River, New Brunswick and Maine 1960, Ottawa, 1961.

Saint John River Basin Board: Annual Report - Saint John River Basin Board, 1971.

Peter MacLoughlin Associates Limited: Existing Plans and Planning in the Saint John River Basin, A Preliminary Report on the Subject to the Saint John River Basin Board, 1972.

International Saint John River Water Quality Committee: Report of the Canada-United States Committee on Water Quality in the Saint John River, 1975.

International Saint John River Engineering Board: A Plan for Water Management in the Saint John River Basin, 1975.

Canada-United States Committee on Water Quality in the Saint John River: Report of the Canada-United States Committee on Water Quality in the Saint John River, 1975.

Saint John River Basin Board: A Plan for Water Management in the Saint John River Basin - Final Report of the Saint John River Basin Board, 1975.

International Joint Commission: Water Quality in the Saint John River Basin, 1977.

International Saint John River Water Quality Committee: Review and Update of Water Quality Objectives for the International Waters of the Saint John River Basin, 1980.

International Technical Advisory Sub-committee on Water Quality in the Saint John River: Interpretation of 1979/80 Surveillance Data for the International Waters of the Saint John River Basin, 1980.

International Technical Advisory Sub-committee on Water Quality in the Saint John River: Interpretation of 1980/81 Surveillance Data for the International Waters of the Saint John River Basin, 1983.

Canada/U.S. Committee on Water Quality in the Saint John River: 12 Years of Progress: International Saint John River Water Quality Committee: 1972-1984, 1984.

D. Newfoundland and Labrador

Shawinigan Engineering Company Ltd. and James F. MacLaren Ltd: Water Resources Study of the Province of Newfoundland and Labrador, Montreal, 1968.

Royal Commission on Labrador: Report of the Royal Commission on Labrador, St. John's, 1974.

Shawmont Engineering, Newfoundland Limited: Hydro Electric Potential of Labrador Rivers, 1976.

Environment Canada Lands Directorate: The Ecological Land Classification of Labrador, a Reconnaissance", 1976.

Newfoundland-Labrador Hydro-electric Power Corporation: Study of Hydro-Electric Potential in Southern Labrador, 1978.